



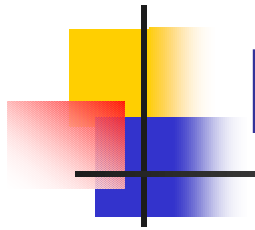
Hijing calculations of dA and other things

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Hard Scattering PWG

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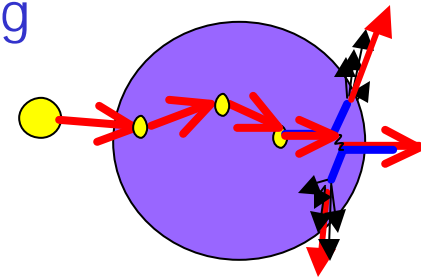
Hijing study of dA

- Look at dA
 - Can we separate jet quenching from other effects?
 - Will we get enough statistics?
- Hijing is used as an example before our data is taken
 - I would like our final result to be INDEPENDENT of the model.
 - dA will give us this handle
 - Statistics assuming Tony's numbers appear to be enough (as shown by many others)
- I place no credence in the model – in fact it is probably not correct. Its just to see the general effect

What are the effects?

- Effects – hard scattering is the probe

- 1) Npart /Nbin scaling
- 2) “Cronin effect”, initial state quark scattering
 - 1) i.e. p_T broadening/Enhances higher p_T
 - 2) reduced role at high energy
- 3) Nuclear shadowing
 - 1) Gluon shadowing
 - 1) is not measured/ large role at RHIC
- 4) Jet quenching (!)



- Handles

- pp gives us the initial hard scattering
- dA should give exhibit 1,2,3
 - Will allow us to MEASURE shadowing and cronin
- AA either
 - Exhibits 1,2,3 (should look like ~ dA)
 - Exhibits all 4 effects (should look different than dA)

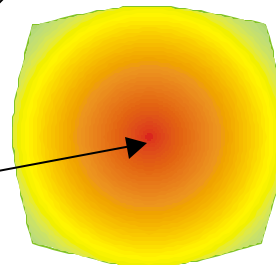
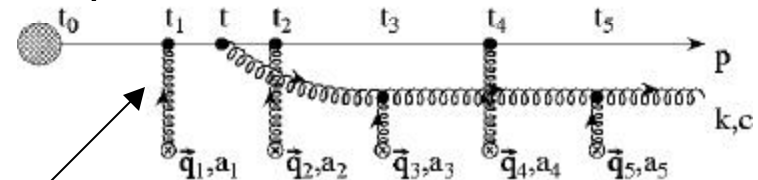
Parameters used

■ Hijing

- pp,dA,AA, SiSi – various energies (mostly 200 GeV), centralities
- Cronin (default values)
- Shadowing (default values)

■ Jet quenching

- Parameters
 - $dE/dx \sim .25 \text{ GeV/fm}$ for quarks (2x for gluons)
 - Mean free path = 1 fm (default)
- Hijing model has
 - Constant dE/dx
 - Uniform fireball
- A More realistic model
 - $dE/dx \sim L$ (interference)
 - More dense in center



Baier, Dokshitzer, Mueller, Schiff, hep-ph/9907267
Gyulassy, Levai, Vitev, hep-pl/9907461
Wang, nucl-th/9812021
and many more.....

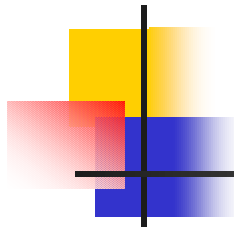
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Luminosities, Nevents, Nbin

- Used Luminosities from Tony's RBUP writeup
- Nbin and Npart taken from Klaus Reyger's `glauber_mc` package (dave- I couldn't compile glauher anymore)
 - Hijing wants impact parameter, bmin and bmax
 - Just took simple minded fraction of cross section

						Nbinaries		
	lum	ub-1	cs (mb)	nminbias	n10% cent	1fm	10%	minbias
AuAu	242		72000	1.7e9	1.7e8	1140	912	230
dAu	15573		12200	3.9e10	3.9e9	17	16	7.6
pp	3.8e6		50	1.14e11	-	1		
Sisi	8260		23000	1.9e11	1.9e10	67	58	17.5

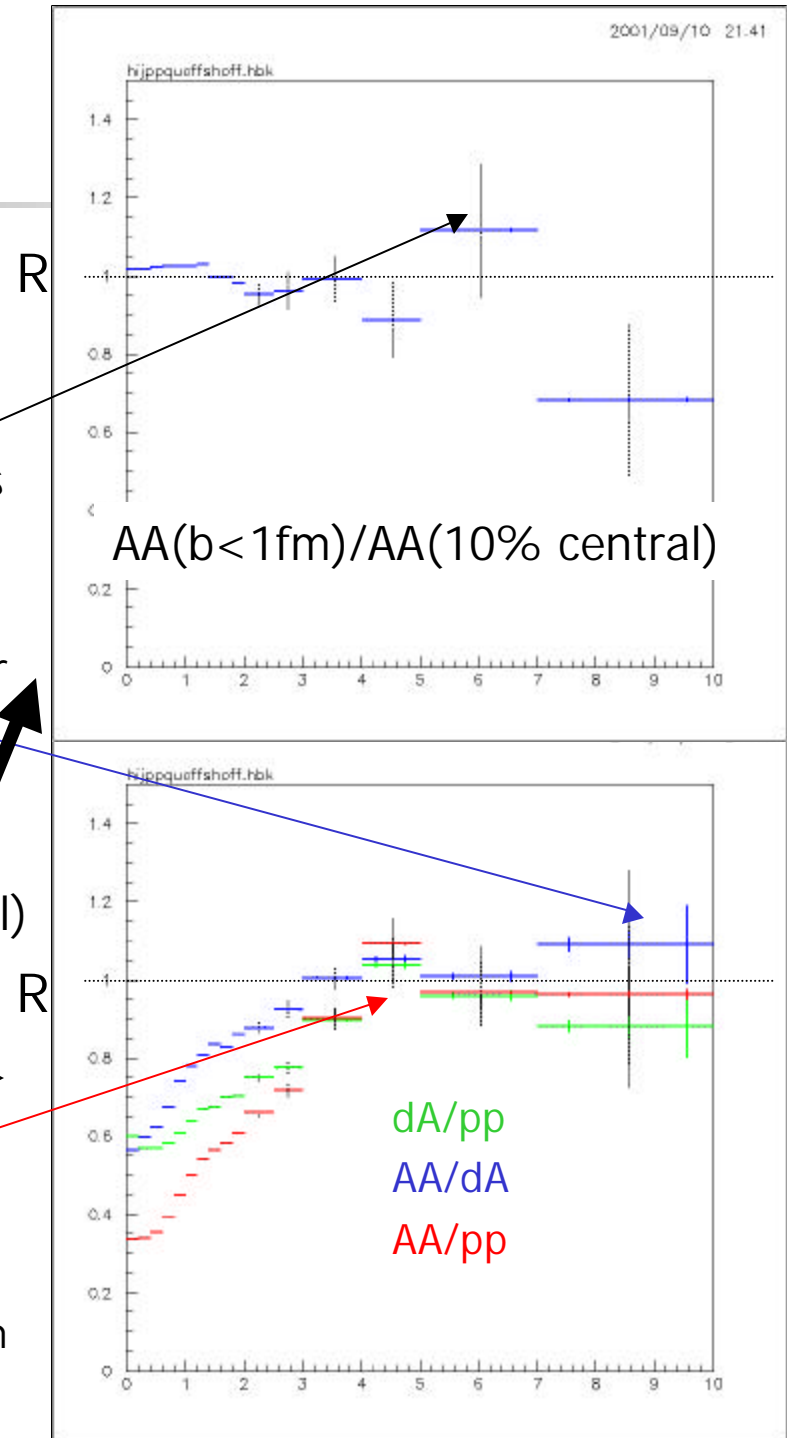


Bugs

- Some problems when running hijing under linux and g77
 - Local subroutine variables not saved between calls. SAVE statements need to be added
 - Some variables are not initialized unless a loop is entered. For g77 loops are not run once. These variables must be initialized.

Method

- Threw ~10K to 10M events.
- Binned events to get reasonable MC statistics.
 - Black dotted error bars reflect MC statistics
- Scaled up to assumed integrated luminosity
 - Colored error bars (barely visible) in smaller bins reflect statistics from assumed data
- For central events, I threw $b < 1\text{fm}$ to avoid issues of nbin etc
 - To check I plot $AA(b < 1\text{fm})/AA(10\% \text{ central})$ normalized to nbin.
- Check AA/pp , dA/pp , AA/dA with no shadow, no Cronin, no quench
 - Shape comes from $[c_1(p_T) * N_{part} + c_2(p_T) * N_{bin}] / N_{bin}$
 - Should go 1 at high p_T
 - Needed a 10% scaling down of N_{bin} – From difference in Hijing and glauber_mc?



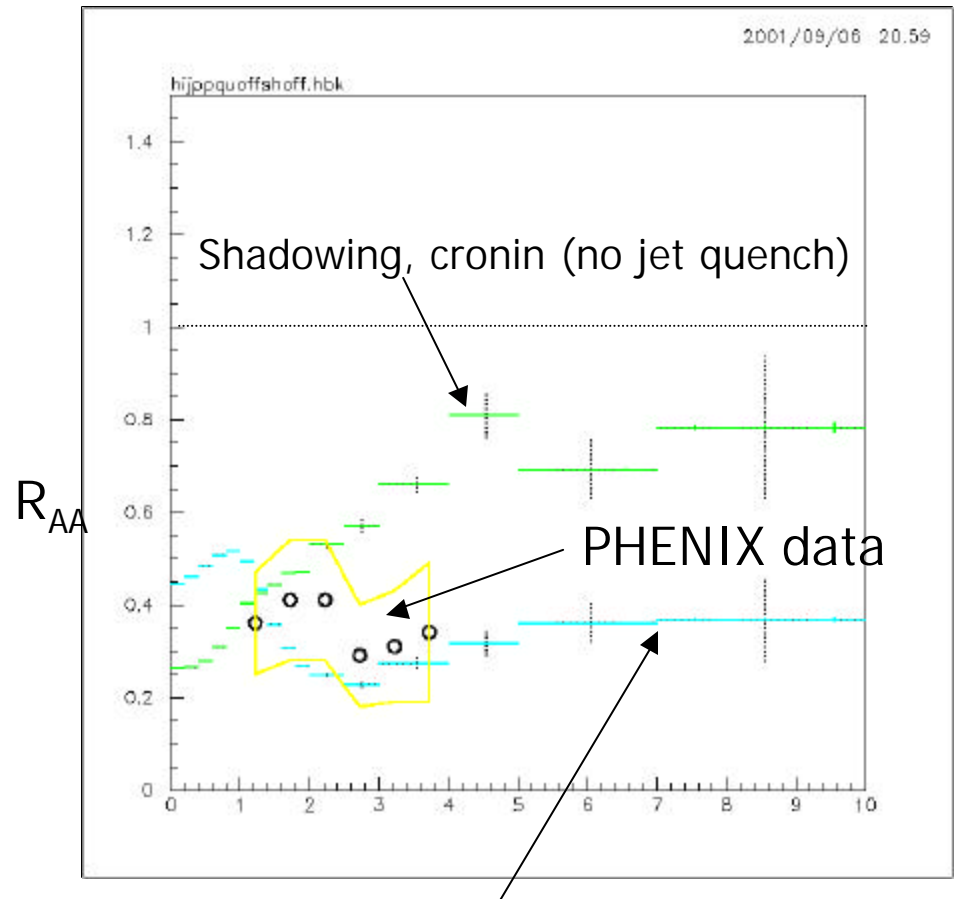
Where are we, vs prediction?

- Pi0 data

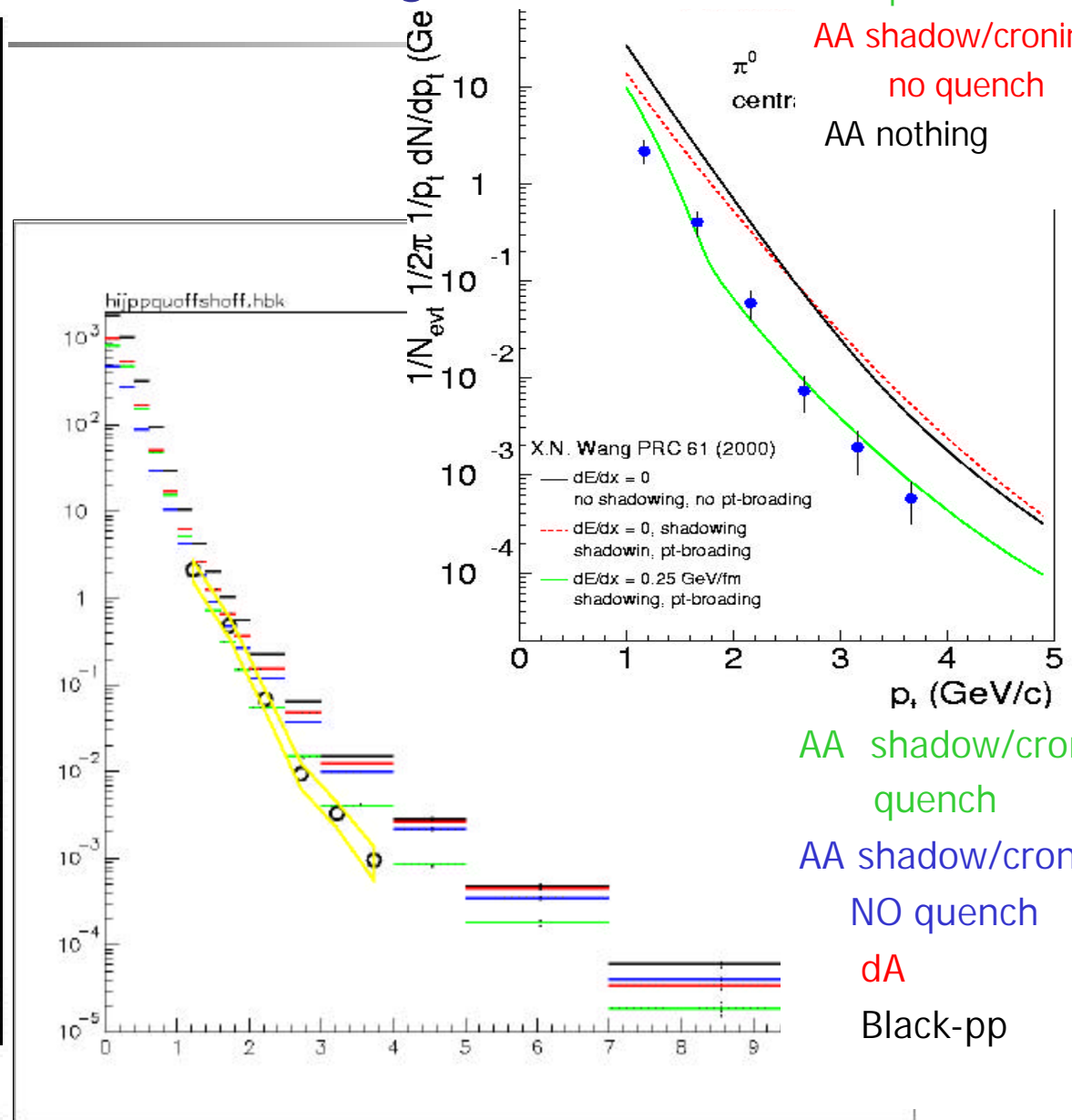
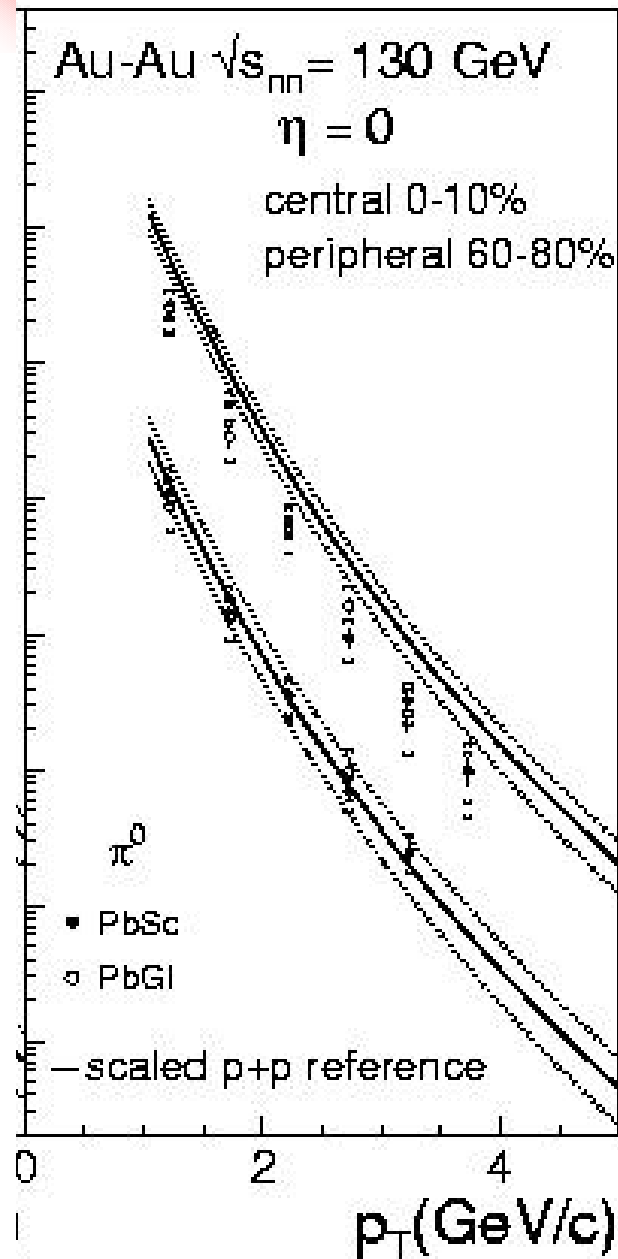
- Compare 130 GeV data vs predictions at 200 (data from table 10 of final analysis note- errors= s_+ , band drawn by paw)

- Notes

- Data far away from 1
- Consistent with the jet quench hypothesis
- But the non-quench hypothesis is scary. E.g. $\times 0.7$ (more shadowing) makes non-quench data also consistent

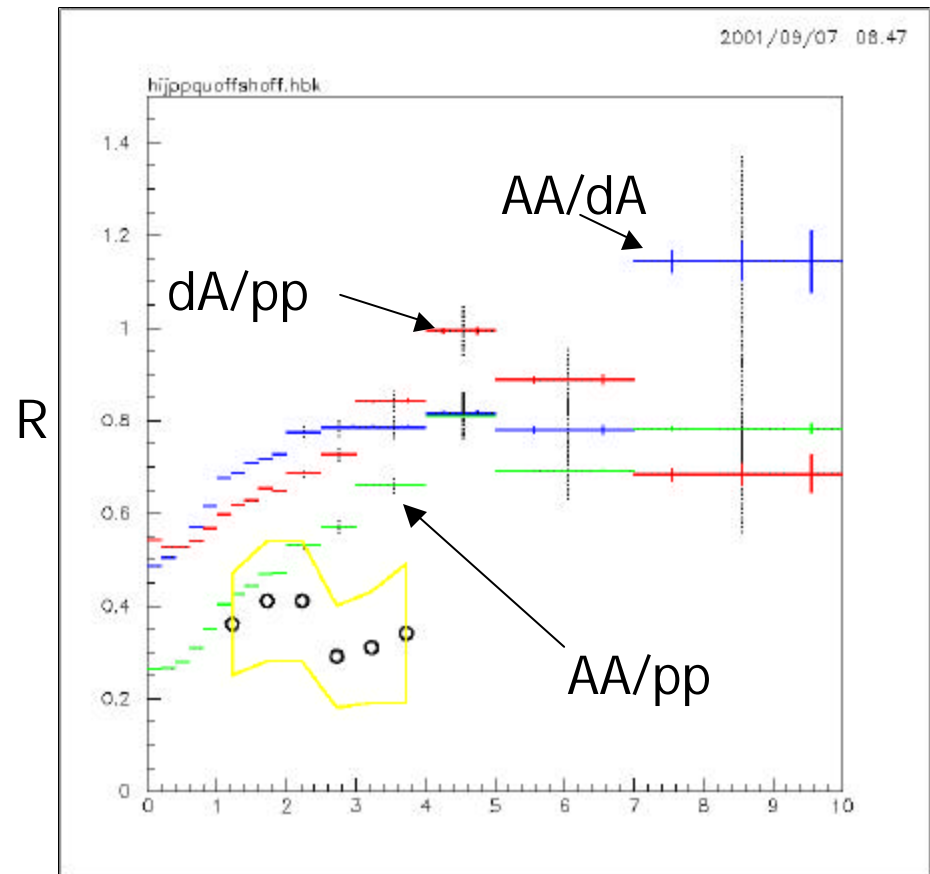


Pt spectra (scaled by nbin)



First assume NO jet quench

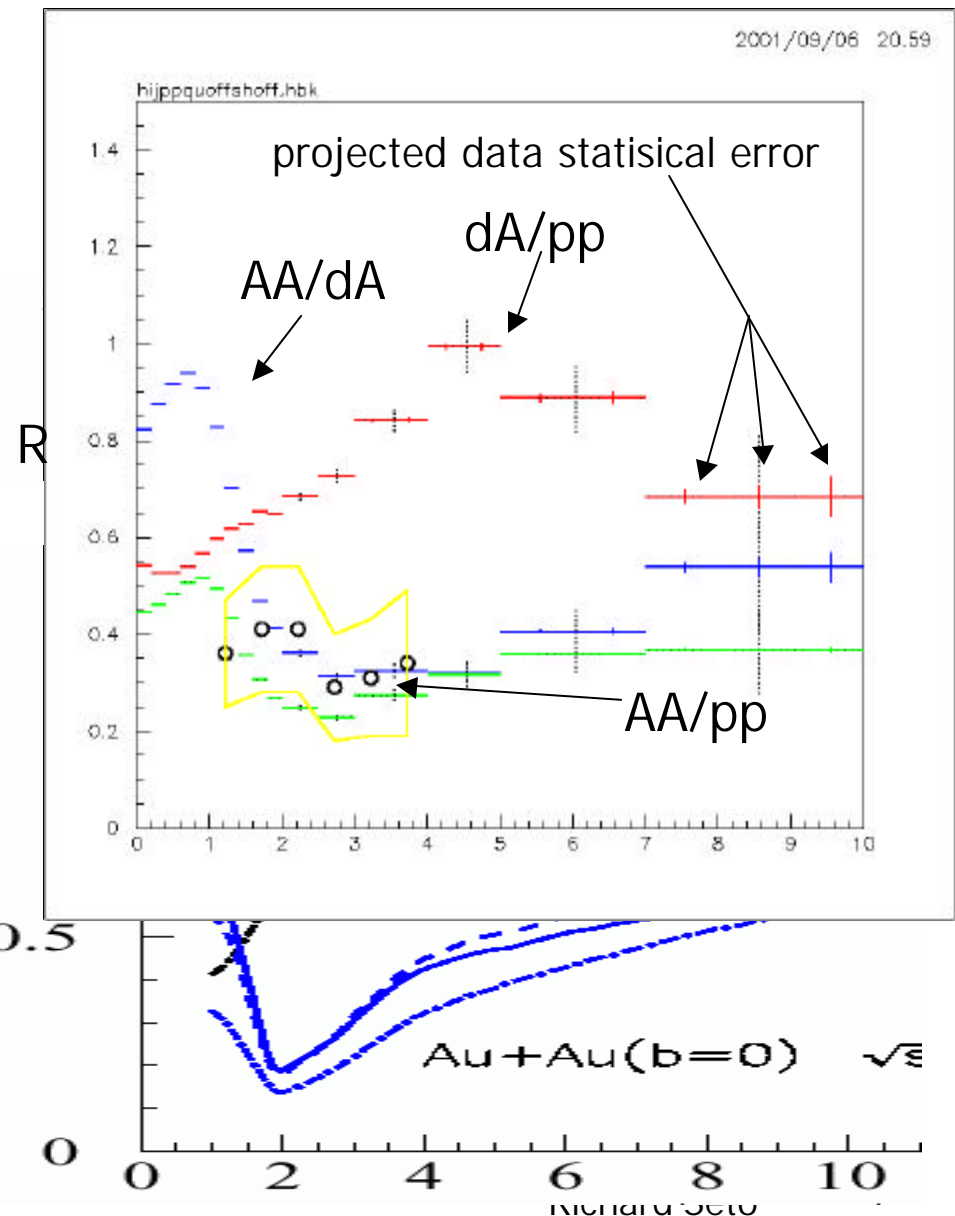
- dA/pp and AA/pp have similar shapes
 - Below 1 at high pt because of shadowing
 - Rise different because dA and pp have different number of participants
 - Cronin effect and shadowing oppose each other

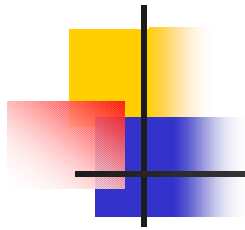


Assume jet quench

- dA/pp and AA/pp look very different!
 - Only AA exhibits the quench
- Bottom line
 - If dA and AA look alike no jet quenching
 - If dA and AA look different – jet quenching (I.e. look at AA/dA)
 - Looks like we will have enough statistics in pp,dA,AA if we get what is in Tony's write up.

$R_{AA}(p_T)$





Conclusions

- Statistics we are requesting for dA run is adequate
- If
 - our effect is shadowing
 - dA/pp will look similar to AA/pp
 - our effect is jet quenching
 - dA/pp will look very different